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Marshall Center Experts Support Orbital Sciences Mission to Station

By Tracy McMahan

A multitude of NASA research investigations, crew provisions, hardware and science experiments from across the country arrived at the International Space Station July 16 aboard Orbital Sciences Corp.'s Cygnus spacecraft. The cargo craft launched aboard Orbital's Antares rocket from NASA's Wallops Flight Facility at 11:52 p.m. CDT Sunday.

Marshall Space Flight Center experts

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The Orbital Sciences Corporation Antares rocket launches from Pad-0A with the Cygnus spacecraft onboard, Sunday, July 13, 2014, at NASA's Wallops Flight Facility in Virginia. (NASA/Bill Ingalls)

Looking Back, Surging Ahead: From Apollo 11 to SLS

The nation looks back in celebration this week, remembering the 45th anniversary of Apollo 11: the exhilaration of liftoff on July 16, 1969; the harrowing moon landing of the Eagle One module four days later; and those first, amazing steps taken on the lunar surface by astronaut Neil Armstrong.

At the Marshall Space Flight Center, where engineers and technologists built the Saturn V launch vehicle

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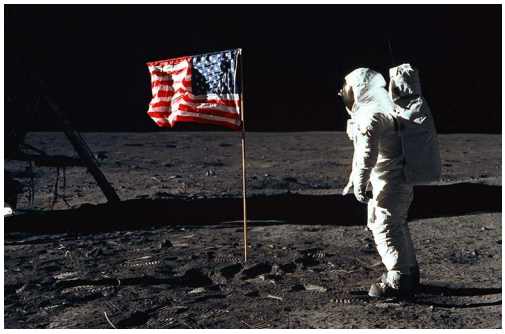


Lunar module pilot Edwin "Buzz" Aldrin Jr. regards the deployed United States flag during an Apollo 11 extravehicular activity (EVA) on the lunar surface. (NASA)

'Diffusing' the Situation: Marshall-Developed Hardware for Propellant Tanks May Benefit Future SLS Missions

By Megan Davidson

Take a two-liter bottle, and fill it with water. Now, turn it upside down. Did you see a lot of bubbles as the liquid drains rapidly from the top? That's because air is trying to get back in the bottle due to the low pressure created in the space above the liquid as it runs out.

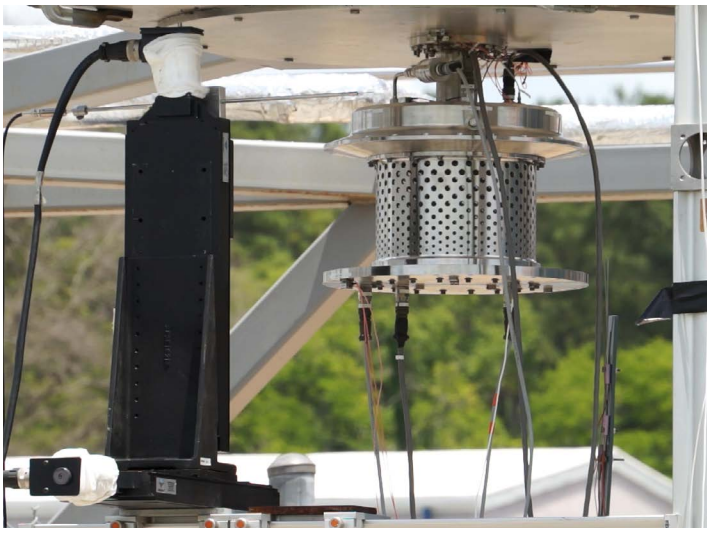
When it comes to liquid propellant tanks for rockets, the same scenario applies. While the engines are running, fuel drains at a rapid speed from the tanks. However, to prevent the low pressure from reducing the controlled flow of the propellant, a pressurization system is required to maintain the density and required flow rate of the rocket fuel. But when you're talking about millions of pounds of fuel, you don't want to just shoot in gas that impinges directly on the liquid surface. Instead, that's what a special piece of hardware is for -- to "diffuse the situation" in the tank and allow gas to flow uniformly at the lowest velocity possible and not stir up to the surface of the liquid.

That hardware, called a diffuser, is no stranger to rocketry. It was used during the space shuttle era. But these days, engineers at NASA's Marshall Space Flight Center have taken that proven design and cut it down to a much smaller size.

"Typical diffuser designs generally have long cylinders," said Mike Martin, lead on the low-profile diffuser project at the Marshall Center. "A lot of times, those diffusers don't make full use of the area in the tank. Our idea was to create a diffuser that makes a much smaller footprint without it severely impacting the performance of the pressurization system. That's how we came up with the low-profile diffuser, which is only about 10 inches tall.

"Using a smaller diffuser can allow us to raise the liquid level up higher and add more rocket fuel," Martin added. "When you do that, you have the potential to increase the amount of payload that you can carry on future launch vehicles, like the Space Launch System."

NASA's Space Launch System (SLS) will be the biggest, most powerful rocket in history, making it possible for future explorers to travel on deep space missions to an asteroid and ultimately to Mars.



The low-profile diffuser undergoes a round of tests at the Marshall Center. For the testing, the hardware is mounted to a test rig, and run for two to three minutes to gather velocity data and validate computational fluid models used to design it. (NASA/MSFC)

The Boeing Co. is the prime contractor for the SLS core stage, and is designing and building the flight diffusers for the rocket's liquid oxygen and liquid hydrogen tanks. Boeing is using the same Marshall facility where the low-profile diffuser is being tested, which is a "win-win" according to Keith Higginbotham, task lead for Marshall's Spacecraft Payload Integration & Evolution Office.

"Having Boeing and our team use the same testing facility not only has reduced costs, but we've been able to help Boeing gather additional data using our instrumentation for their flight diffusers. We also can conduct comparative tests to see if our low-profile diffuser may be a better option than the current flight diffusers for later SLS models."

The low-profile diffuser has already finished phase one of its trial series, which included about 30 different tests. For the next round of testing, it will be mounted to a test rig, and run for two to three minutes to gather velocity data and validate computational fluid models used to design it. Testing is scheduled through July. The design, production and testing of the hardware is a collaborative effort between Marshall's Engineering

*See **'Diffusing'** on page 4*

The View From the Ground: Space Station Science Blog Features Marshall Center's Stephanie Dudley

By Bill Hubscher

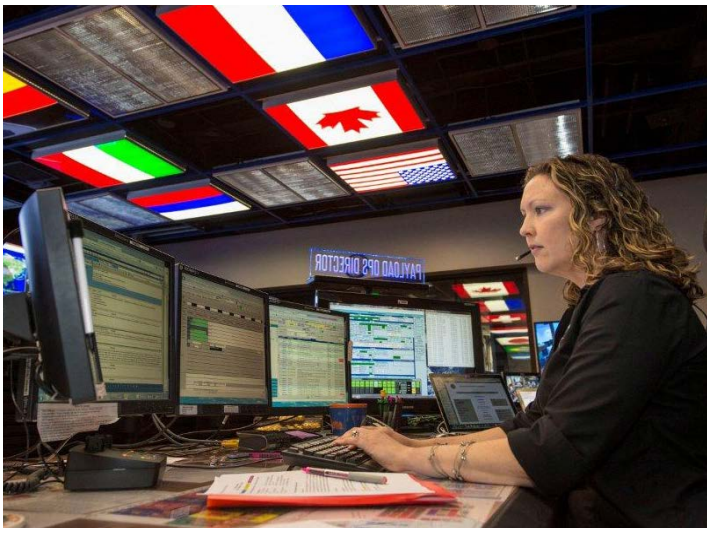
"Wow… look at what we accomplished today."

That's a sentiment often expressed daily by Stephanie Dudley, a payload operations director for the International Space Station's Payload Operations and Integration Center, located at the Marshall Space Flight Center. Dudley is featured in the latest online post for "A Lab Aloft" -- a NASA blog written by scientists and engineers focusing on space station research and technology.

While astronauts perform cutting-edge research on the station, the support of people like Dudley is essential to the science conducted in orbit.

"Twenty-four hours a day, seven days a week, astronauts aboard the International Space Station are living and working in the most sophisticated laboratory ever built," Dudley says in the post. "It's my job to keep track of all that research and ensure that the orbital lab runs like a well-tuned orchestra. It's a thrilling, high-intensity job that leaves me exhausted at the end of the day, but I love it."

For more of her behind-the-scenes look at work performed on the ground to support science in orbit, visit the "A Lab Aloft" blog:



Stephanie Dudley works a shift as an International Space Station payload operations director in the Payload Operations Integration Center at the Marshall Space Flight Center. (NASA/ Fred Deaton)

http://blogs.nasa.gov/ISS_Science_Blog/

Dudley also helped take viewers on a video tour of the Payload Operations Integration Center at the Marshall Center's YouTube channel:

http://youtu.be/mOBdy272SHk

Hubscher, an ASRC Federal/Analytical Services employee, supports the Office of Strategic Analysis & Communications.

Model of Space Launch System Launched in Building 4220 Lobby

A 1/25 scale model of the Space Launch System was recently built by the Office of Strategic Analysis & Communications Public and Employee Communications Office exhibits team and positioned in the new Building 4220 lobby at the Marshall Space Flight Center. At left are Todd May, SLS program manager, and Holly Snow; from the top of the stairs are OSAC team members Kirk Pierce, Dan Fox, Daniel McFall, Pedro Rodriguez, Robert Johnson, Kevin Irvine, Chris Owen, Richard Williams and Chad Cameron; Kimberly Robinson of SLS Strategic Communications; and team members Terry White and Aaron Stanfield (kneeling). (NASA/MSFC/Emmett Given)

Diffusing

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Directorate and Spacecraft Payload Integration & Evolution Office, within the SLS Program.

The first flight test of the SLS will feature a configuration for a 70-metric-ton (77-ton) lift capacity and carry an uncrewed Orion spacecraft beyond low-Earth orbit to test the performance of the integrated system. As the SLS evolves, it will provide an unprecedented lift capability of 130 metric tons (143 tons) to enable missions even farther into our solar system.

Watch a video on the low-profile diffuser work here.

Davidson, an ASRC Federal/Analytical Services employee, supports the Office of Strategic Analysis & Communications.

Mission to Station

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contributed to making the mission happen. NASA works with Orbital and other commercial cargo providers to support flight readiness, review data and resolve issues. Marshall has the capability to provide expert analysis for turbomachinery and materials, and to perform diagnostic modeling.

"The science command post for station experiments is located right here at Marshall, so we understand the importance of regularly delivering cargo to enhance research," said Erin Betts, a manager in Marshall's Flight Programs and Partnerships Office. "With almost 55 years of experience in engine development, testing and data analysis at Marshall, we perform propulsion system analyses that help make missions to the station successful."

The mission is the company's second contracted cargo delivery flight to the station of at least eight missions to the orbital laboratory planned through 2016. For this mission, Cygnus delivered more than 3,000 pounds of supplies to the station, which will greatly enhance the research capability of the Expedition 40 space station crew.

During the months before the mission, the Marshall team specifically helped with analyses on the Aerojet Rocketdyne AJ26 rocket engine that powers the first stage of the 133-foot-tall Antares rocket. During the July 13 launch, the engines burned oxygen and RP-1 kerosene rocket fuel and fired for nearly four minutes, boosting the rocket out of the dense lower atmosphere and into the orbital plane of the space station.

"We were happy to work with the space station Commercial Resupply Services office at the Johnson Space Center alongside the Orbital and Aerojet Rocketdyne teams to ensure a successful resupply mission to the station," said Matt Devine, a Marshall propulsion engineer. "We have unique in-house capabilities for modeling, materials analysis, high-speed data reduction, and thermal evaluations and are proud of the role we played ahead of the Orbital launch."

Marshall and other NASA centers support the Commercial Resupply Services program through NASA's Johnson Space Center which manages the program. Marshall also has Space Act Agreements with commercial companies to provide technical assistance. The Marshall Center is the location of the Payload Operations Integration Center, which operates station science experiments around the clock, 365 days a year.

The International Space Station is a convergence of science, technology and human innovation that demonstrates new technologies and makes research breakthroughs not possible on Earth. The space station has been continuously occupied since November 2000. In that time, it has been visited by more than 200 people and a variety of international and commercial spacecraft. The space station remains the springboard to NASA's next giant leap in exploration, including future missions to an asteroid and Mars.

McMahan is a public affairs officer in the Office of Strategic Analysis & Communications.

Surging Ahead

Continued from page 1

which carried Apollo 11 and its crew into history, engineers and researchers also will reflect proudly on the heady success of the past. Then they'll return to their labors, preparing the successes of the future.

The Marshall Center is home to the Space Launch System Program Office, which leads development and delivery of the most powerful launch vehicle ever built, eventually even eclipsing the mighty Saturn V. The Space Launch System, or SLS, is destined to carry new missions of human exploration into the solar system. Here, the men and women of NASA are hard at work, writing a breathtaking future history to rival those Apollo-era achievements and surpass them.

Since September 2011, the program, under Marshall's leadership, has sought to develop the critical systems and technologies, refine the hardware manufacturing requirements, test the powerful engines and enable the path to construction for America's next flagship in space.

NASA and the nation stand on a new horizon, poised to take the next giant leap -- traveling deeper into the solar system to resolve scientific quandaries, pursue the search for life beyond our world and extend humanity's presence in the cosmos. Just as the Apollo-era missions blazed a path that led America's explorers to the surface of the moon, today Marshall Center researchers and engineers and their counterparts at NASA centers and partner facilities around the country are extending that path -- clearing the way to journey to near-Earth asteroids, pursue the Path to Mars and travel beyond.

Reflecting on the work of a great team in the wake of the successful Apollo 11 mission, chief rocket scientist Dr. Wernher von Braun, the Marshall Center's first director, expressed his hope that such missions would be only the beginning of humanity's quest to venture forth from its "planetary cradle," and that the "brave Apollo [11] astronauts" could rest "assured that their trip was not in vain, that our reach into space will be continued and that from their brief journey of exploration there will be a brighter future for mankind."

NASA's Space Launch System, soon to be the most powerful rocket in history. (NASA)

Events Celebrate 15 Years of Science from Chandra X-ray Observatory

On July 23, 1999, space shuttle Columbia – with NASA's first female commander, Eileen Collins -- launched into orbit and deployed the Chandra X-ray Observatory.

Fifteen years later, Chandra continues to deliver spectacular results to the scientific community and the public. With its unrivaled sensitivity and resolution in X-ray light, Chandra's telescope observes the debris of exploded stars, matter falling into black holes, hot gases pervading galaxy clusters and much more.

NASA's Marshall Space Flight Center manages the Chandra program for NASA's Science Mission Directorate in Washington. The Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, controls Chandra's science and flight operations.

Two special events celebrating the 15th anniversary of Chandra are free and open to the public:

Google+ Hangout

Engage with Chandra experts in a Google+ Hangout on July 22 at 2 p.m. CDT to hear about Chandra's discoveries. For details on how to participate in the Hangout, visit the "15 Years of Chandra" page on Google+. Information will also be presented on the Marshall Center's Facebook and Twitter pages.

Panelists will include Harvey Tananbaum, former

director of the Chandra X-ray Center (CXC) and senior scientist at the Smithsonian Astrophysical Observatory (SAO); Scott Wolk, astrophysicist at SAO/CXC; and Julie Hlavacek-Larrondo, an Einstein Fellow at Stanford University.

Pass the Torch Lecture Panel Discussion

Explore the X-ray technology behind the Chandra Observatory and see the universe in a new and dynamic way during a panel discussion celebrating 15 years of science from the telescope. The discussion, part of the Pass the Torch Lecture series at the U.S. Space & Rocket Center, will be at 5:30 p.m. July 24 in the Digital Theater of the center's Davidson Center for Space Exploration.

The panel, composed of NASA Marshall Space Flight Center project managers, scientists and engineers, will describe development and testing of the telescope as well as discuss the discoveries behind the Chandra Observatory.

Space Launch System Design Review Featured on NASA-TV

The continued progress on NASA's Space Launch System, or SLS -- the agency's rocket program managed at the Marshall Space Flight Center -- is featured in the latest edition of "This Week @NASA," a weekly video program broadcast nationwide on NASA-TV and posted online.

The SLS program reached a major milestone when a team of engineers and program managers from NASA and the Boeing Co. met June 30 and July 1 for a critical design review of the rocket's core stage.

Boeing is the prime contractor for the core stage of the rocket, which will take humans farther into the solar system than ever before. The review proved the main propulsion element of America's next great rocket is mature enough for production.

This and previous episodes of This Week @NASA are available for viewing at the NASA-TV YouTube channel:

www.youtube.com/NASAtelevision.

Marshall Association Welcomes General Via, Awards Student Achievers

Johnny Stephenson, right, deputy director of the Marshall Space Flight Center's Office of Strategic Analysis & Communications, greets Gen. Dennis Via, commander of the U.S. Army Materiel Command on Redstone Arsenal. Via, who oversees a work force of more than 67,000 dedicated military and civilian employees, was the guest speaker at the July 10 luncheon meeting of the Marshall Association, the center's professional, employee service organization. Marshall team members can learn more about the organization on ExplorNet at https://explornet.msfc.nasa.gov/groups/marshall-association. (MSFC/Emmett Given)

During its July 10 luncheon, the Marshall Association announced the recipients of its annual scholarships, presented to organization members' college-bound children for their outstanding scholastic achievement. Winners for 2014 include, from left, Adrienne M. Cumming, Brandon K. Hicks, Katie E. Fogle and James P. Grubbs. Cumming is the daughter of Suzanne and Todd Cumming; Hicks is the son of Gregory and Roslin Hicks; Fogle is the daughter of Sheila and Dr. Frank Fogle; and Grubbs is the son of Shannon and Rodney Grubbs. Scholarship recipients who were unable to attend the award ceremony were Ashwin Ramachandran, son of Geetha and Dr. Narayanan Ramachandran; and Ashlyn Turner, daughter of Kasondra Gipson. The association funds the scholarships through membership dues and donations. Winners were chosen by a team of Marshall Association members, based on scholarship applications students submitted earlier in the year. (MSFC/Emmett Given)